lodged. His observing cap was on his head, and it is presumed that a sudden spasm from heart disease struck him down while on his way to the observatory to commence his nightly work.

Dr. Peters was a man of the highest integrity and honour, courteous in his bearing and of a most kindly nature. He was an accomplished scholar, and had great linguistic attainments, even to the extent of publishing a scientific paper in the Turkish language. He was an able and accurate mathematician and astronomer, whose fame is due "not to transcendent genius, or brilliant episodes, but to faithful, diligent toil, and life-long devotion to his chosen profession."

He was elected an Associate of this Society January 10, 1879.

OTTO AUGUST ROSENBERGER, who at the time of his death was the senior Associate of this Society, was born on August 10, 1800, at Tukkum, in the province of Courland, in Russia. He was the son of a medical man, who, in 1811, migrated to Königsberg, in Prussia, probably in consequence of his brother being the director of the Gymnasium in that city, from whom young Rosenberger then received his early education. He entered the University of Königsberg as a student of mathematics in 1819, and pursued his academical studies till the autumn of 1825.

At this period the immortal Bessel was Director of the Königsberg Observatory. He readily recognised the talent displayed by the foreign student, who was one of his pupils at the University, and in 1823 he appointed him an assistant at the Observatory. In this position he remained for three years. During this period Rosenberger published his first scientific paper, which will be found in the first volume of the *Astronomische Nachrichten*, on the elements of the orbit of the comet of 1821; his second paper, on the elements of the comet of 1818, was published in Bode's *Jahrbuch* for 1824.

In 1826, a vacancy having occurred at the Observatory of Halle, Bessel proposed his assistant for the post, upon which Rosenberger was appointed Extraordinary Professor of Applied Mathematics at the Halle University, and Observer at the Observatory. In quitting Königsberg, Bessel recorded his good services to astronomy by saying: "The journals of the Observatory for the last few years contain proofs of his activity in the functions of this institution, which by his departure has lost an excellent assistant."

Rosenberger entered upon his duties at Halle in October 1826, having in the previous July taken his Doctor's degree at Königsberg. Five years later he was promoted to be Ordinary Professor of the University, and Director of the Observatory. In Halle his activity as an astronomer was seriously hampered by the condition of the Observatory, which had been built in 1790 merely for educational purposes. There were none but antiquated instruments, and not even a reliable clock. Consequently the first task he proposed to himself was to procure a

small meridian circle, a Fraunhofer telescope, of 6 feet focal length, and two clocks. Four years seem to have elapsed before these instruments were obtained and the necessary structural alterations made. But even then no systematic observations appear to have been made, and, indeed, it would seem that observational astronomy was somewhat distasteful to Rosenberger. During the long period of sixty-four years that he held the position of Professor in the University of Halle, he trained numerous pupils in mathematics, but, strange to say, none in astronomy. One of his pupils records from his own personal recollection that Rosenberger could scarcely ever be induced to bring the existing instruments into requisition for the purpose of astronomical instruction. The plea of the instruments being out of date, and the walls of the Observatory damp, hardly affords sufficient explanation of this anomaly in the life of one who to mathematical astronomy was able to contribute work of conspicuous and enduring merit.

In the history of astronomy Rosenberger is known solely by the remarkable investigation of the orbit of Halley's Comet, which he undertook in anticipation of its predicted appearance in 1835. The history of this comet is so well known that it may be considered superfluous to refer in detail to the interest excited in its reappearance in that year. Four mathematicians entered the field to calculate its orbit and determine the time of its perihelion passage—two Frenchmen, Damoiseau and Pontécoulant, and two Germans, Lehmann and Rosenberger. The methods adopted by these four distinguished astronomers in their investigations are well and succinctly explained in the address of Mr. (now Sir George) Airy, in the year 1837, on the occasion of presenting the gold medal of this Society to Professor Rosenberger.* The whole research of Rosenberger on Halley's Comet is contained in a series of papers published in the *Astronomische Nachrichten.*

In the first paper (*Ast. Nach.* No. 180) he gives a calculation of the elements of the orbit at the appearance in 1759, from all available observations made in that year. In No. 196 of the same journal, he investigates the elements at the appearance of 1682, from the observations of Flamsteed, Hevelius, De la Hire, and Picard. These two papers were described by Mr. Airy as "undoubtedly among the most complete papers of the kind that have ever appeared."

In No. 250, Rosenberger investigates the perturbations of the comet from 1682 to 1759. In this paper the effects of all the planets are estimated in the following manner :—" To 30° of eccentric anomaly the perturbations are computed, referring the comet's place to the Sun ; from 30° to 60° the perturbations of *Mercury, Venus,* the Earth, and *Mars* are computed, referring the comet's place to the centre of gravity of the solar system ;

* *Monthly Notices,* vol. iv. p. 57.

and from 60° to 300° those of *Jupiter, Saturn,* and *Uranus* are conducted in the same manner. From 300° to 330°, and then to 360°, the steps of the operation in the first part of the orbit are retraced."

In No. 276, he computes the perturbations from 1759 to 1835, and points out that the perturbations after 300° of eccentric anomaly are so excessively great that a very accurate knowledge of the comet's orbit is necessary to calculate them properly. In a further paper, No. 288, he indicates the importance of frequently changing the elements in the computation of the perturbations. "In some instances, in the first revolution, the elements were altered for every 2° of eccentric anomaly. The effect of these hitherto neglected cautions in computing the perturbations through only 16° of eccentric anomaly is an alteration of four days in the periodic time."

Bessel, in lecturing the following year upon the researches which had been made upon this comet, says: "Rosenberger's calculations have been the most successful ones. Certainly Pontécoulant, by a supplementary calculation published at a subsequent date, though still before the reappearance of the comet, has hit upon the time of perihelion passage more closely than Rosenberger, but a comparison of the other items of the prediction results in Rosenberger's favour. The values ascertained by Rosenberger are so approximately correct that they coincide with the whole series of observations which have now been made, but for some trifling discrepancies, which would have escaped detection had not the observations possessed such high accuracy."

As is well known, the comet was discovered on August 5, 1835, in a position within one degree of the place assigned to it for that day in Rosenberger's Ephemeris, and it arrived at perihelion on November 16, only four days after the time predicted by him.

The high merit of this elaborate investigation is well expressed in the concluding paragraph of Mr. Airy's address already referred to, and which may be here quoted:—" Professor Rosenberger has used the theory of perturbations in its most accurate form, and in one of its most delicate parts he has introduced an important correction. He has computed the perturbations of all the elements for the first as well as the second revolution; Damoiseau and Pontécoulant having only computed the change of mean motion and epoch for the first revolution. He has included in his calculations the effect of several planets which had been totally omitted by other mathematicians. He has not only computed the perturbations, but has also, from the observations of different astronomers at the former appearances, investigated the elements at those times by a process of the most accurate kind. So complete are the whole of these computations, that if names were taken, not from the discoverers of these bodies, or from those who conjecture their identity, but from those who, by

accurate calculations on a uniform system, combine the whole of our information relating to them, we should call this body, not Halley's, but Rosenberger's comet."

It must always be a subject of great regret that with this successful effort Rosenberger should have terminated his labours in astronomy. It does not appear that he published any further scientific work from 1836 to the day of his death.

He gave lectures on mathematics and astronomy regularly, though as a rule but to a small circle of students. Apart from his educational activity, he rendered valuable services to the university and faculty by the readiness with which he undertook manifold administrative functions, as well as by the conscientiousness, precision, and ability with which he performed them. He repeatedly and creditably filled the office of Dean of the Philosophical Faculty. For some period of his life at Halle he took a prominent part in politics, but of late years he seldom appeared in public except to attend some academical function.

On May 13, 1886, he celebrated the rare event of the sixtieth anniversary of his appointment as a professor, on which occasion the Emperor bestowed on him the second class order of the Red Eagle. Professor Rosenberger never married. At the time of his death in 1890, January 23, at the age of nearly ninety years, he was the senior Professor of the University of Halle and of the Philosophical Faculty.

He was elected an Associate of this Society April 10, 1835.

HERMAN SCHULTZ was born on July 7, 1823, at Nygvarn, in the Swedish province of Södermanland, where his father had a manufactory. His early education was received at home, after which he entered the Lycée of Upsala, and in 1844 he took his degree as Bachelor of the University of that city. He received a Doctor's degree in 1855, and in the following year was nominated 'Professor agrégé' at the University. In 1859 he became Assistant Professor, and was nominated Observer at the Astronomical Observatory. Finally, in 1878 he was appointed ordinary Professor of Astronomy, and Director of the Observatory as successor to Dr. Svanberg.

In the year 1860 the Observatory of Upsala was furnished with an equatorial refractor by Steinheil, the object-glass of which was 24 centimètres diameter, and of 13 feet focal length. The optical part of the instrument was of high excellence, but all the mechanical part of the mounting was very inferior, and necessitated frequent alterations to render the telescope fit for work. With this instrument Schultz made a large number of valuable observations.

After becoming Director, Schultz caused many important alterations and improvements to be made in the buildings of the Observatory. The openings in the transit-room and the room for the prime vertical instrument were much enlarged. Two